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REMOVAL SUPPORT TEAM 2  
EPA CONTRACT EP-W-06-072

November 4, 2008

Mr. James Kearns, On Scene Coordinator  
U.S. Environmental Protection Agency  
Removal Action Branch  
2890 Woodbridge Avenue  
Edison, NJ 08837

**EPA CONTRACT NO: EP-W-06-072**

**TDD NO: TO-0009-0098**

**DOCUMENT CONTROL NO: RST 2-02-F-0704**

**SUBJECT: QUALITY ASSURANCE PROJECT PLAN – THE CORNELL-DUBILIER  
ELECTRONICS SITE**

Dear Mr. Kearns:

Enclosed please find the site Quality Assurance Project Plan (QAPP) for perimeter air monitoring at the Cornell-Dubilier Electronics Site located in South Plainfield, Middlesex County, New Jersey.

If you have any questions, please do not hesitate to call me at (732) 565-4448.

Sincerely,

Weston Solutions, Inc.

Matt Foster  
Site Project Manager

Enclosure

cc: TDD File: TO-0009-0098



# SITE QUALITY ASSURANCE PROJECT PLAN

**Cornell-Dubilier Electronics Site**  
**South Plainfield, Middlesex County, New Jersey**

Prepared by:

Removal Support Team 2  
Weston Solutions, Inc.  
Edison, New Jersey 08837

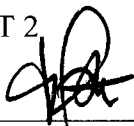
Prepared for:

U.S. Environmental Protection Agency  
Region II - Removal Action Branch  
Edison, New Jersey 08837

DCN #: RST 2-02-F-0704  
TDD #: TO-0009-0098  
EPA Contract No.: EP-W-06-072

**Approved by:**

RST 2



Matthew Foster  
Site Project Manager

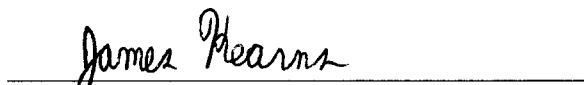
Date: 11/4/08

RST 2

  
Smita Sumbaly, RST 2  
Chemist/QA/QC Specialist

Date: 11/5/08

EPA



James Kearns  
On-Scene Coordinator

Date: 11/10/08

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### **(Continued)**

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The following elements are provided in the RST 2 Generic Quality Assurance Project Plan (QAPP) and are included by reference:

QA REPORTS TO MANAGEMENT

PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

RECORDS MANAGEMENT SYSTEM

LOGBOOK PROGRAM

QUALITY-RELATED DOCUMENTS

INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

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## **LIST OF ATTACHMENTS**

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ATTACHMENT A: Site Maps

ATTACHMENT B: EPA/ERT Sampling SOPs

ATTACHMENT C: NIOSH Method 5503

## **1. INTRODUCTION**

Presented herein is the Site Quality Assurance Project Plan (QAPP) for the sampling event to be conducted at the Cornell-Dubilier Electronics Site by the Region II Removal Support Team 2 (RST 2). The site QAPP has been developed at the request of the U.S. Environmental Protection Agency (EPA) in accordance with the RST 2 generic Quality Assurance Project Plan (Region II RST 2 QAPP).

This plan is based on information currently available and may be modified on-site in light of field screening results and other acquired information. All deviations from the QAPP will be noted in the Sampling Trip Report.

## **2. PROJECT DESCRIPTION**

The Cornell-Dubilier Electronics Site (CDE) is located at 333 Hamilton Blvd, South Plainfield, New Jersey. The Site is the location of a former manufacturer of electronic parts and components, including capacitors. Cornell-Dubilier Electronics, Inc. also tested transformer oils. During their operations, the company dumped PCB-contaminated materials and other hazardous substances directly onto the soil at the site. The Site is on the National Priorities List and is being remediated by the EPA Remedial Program and the U.S. Army Corps of Engineers. The Site is approximately 25 acres in size, including an open field and adjoining wetland complex. The Bound Brook traverses the southeast corner of the Site.

Beginning in 1936, Cornell-Dubilier Electronics, Inc., manufactured electronic components including capacitors at the Site. Polychlorinated biphenyls (PCBs) and chlorinated organic solvents were used in the manufacturing process, and the company apparently disposed of PCBs-contaminated materials and other hazardous substances directly on the facility soils. CDE's activities evidently led to widespread chemical contamination at the facility, resulting in the migration of contaminants to areas nearby to the facility. PCBs have been detected in the ground water, soils and building interiors as well as adjacent residential, commercial, and municipal properties. PCBs have also been found in the sediments of the Bound Brook.

PCB-containing capacitors were dumped in large numbers at the Site, and capacitor debris has been found in the Bound Brook since the Site was first identified. Recent erosion of a portion of the stream bank near the Site (See Attachment A, Figure 1) may have led to a spike in the amount of capacitor debris in the Bound Brook.

An interim Removal Action will begin on October 14, 2008 to armor the banks of the Bound Brook in the area of three culverts and along the wetlands that border the area where PCBs contaminated debris was disposed of during the operational period of CDE. The objective of the Removal Action is to stabilize the banks along the perimeter of the CDE facility in order to eliminate the threat of direct contact with PCBs contaminated debris, and to prevent the migration of debris from the banks along the perimeter of the former CDE facility property. Proposed actions to stabilize the banks will include the clearing of vegetation and the installation of geotextile fabric and rip-rap. A dust monitoring and control program will be implemented

during all Site activities.

### 3. PROJECT ORGANIZATION AND RESPONSIBILITIES

The EPA On-Scene Coordinator (OSC), James Kearns, will provide overall direction concerning project sampling needs, objectives, and schedule. The Removal Support Team 2 (RST 2) Site Project Manager (SPM), Matt Foster, will be the primary point of contact with the OSC. The SPM is responsible for the development and completion of the Sampling QA/QC Plan, project team organization, and supervision of all project tasks, including reporting and deliverables. The Site QC Coordinator will be responsible for ensuring field adherence to the Sampling QA/QC Plan and recording of any deviations. The RST 2 Chemist/QA/QC Specialist, Smita Sumbaly, will be the primary project team site contact with the subcontracted laboratory, if required.

Emergency and Rapid Response Services (ERRS) personnel will arrange for the laboratory analyses of the air samples. RST 2 will transfer custody of the samples to ERRS personnel for shipment to the appropriate lab.

The following sampling personnel will work on this project:

<u>Personnel</u>	<u>Affiliation</u>	<u>Responsibility</u>
James Kearns	USEPA	On-Scene Coordinator
Matt Foster	RST 2	Site Project Manager, Site H & S Coordinator, Site QA/QC, Sample Collection and Management
Smita Sumbaly	RST 2	Laboratory Procurement, if required

The following laboratories will provide the analyses indicated:

Lab Name/Location	Sample Type	Parameters
To Be Determined	Air (Glass Fiber filter and Florisil <sup>®</sup> Tube)	PCBs (Total)

A turnaround time of 24-hours verbal and 21 days written results has been requested for the air samples.

## **4. DATA USE OBJECTIVES, QA OBJECTIVES**

In addition to the following, the data use objectives, QA objectives procedure will be conducted in accordance with Sections A7, B2, B4, and B5 of the Region II RST 2 QAPP.

The objective of this sampling event is to monitor airborne total particulate matter levels during all Site activities using DataRAM-4000 series meters. If required, air sampling for PCBs during Site activities will be conducted (Refer to pages 9-10 for more details). Data will be evaluated to assess potential risks to human health and the environment from exposure to hazardous substances identified at the site.

### **4.1 DATA QA OBJECTIVES**

The overall quality assurance (QA) objective for chemical measurement data associated with this sampling event is to provide analytical results that are legally defensible in a court of law. The QA program will incorporate quality control (QC) procedures for field sampling, chain-of-custody, laboratory analyses, and reporting to ensure generation of sound analytical results.

The EPA OSC has specified a modified definitive QA objective for the collection of air samples. Details of this QA level follow.

### **4.2 QA OBJECTIVES**

As delineated in the Uniform Federal Policy for Quality Assurance Project Plans, Part 2B: Quality Assurance/Quality Control Non-Time Critical QA/QC Activities, the following requirements apply to the respective QA objectives and parameters identified.

The QA protocols for a Screening Data, without confirmation have limited use, specifically for: Emergencies, Health and Safety screening using (e.g. Multi Rae, OVM, Jerome Mercury...etc.). The Field Screening Data objective sampling events are applicable to all sample matrices and include:

1. Sample Documentation (location, date and time collected, batch, etc.)
2. Description of equipment and instrumentation
3. Sample documentation in the form of field logbooks, appropriate field data sheets, and chain-of-custody (when appropriate) records and procedures for field sampling management (e.g., sample location, transport, storage, sample collection methods and shipping procedure)



4. Calibration of all monitoring and/or field-portable analytical equipment prior to collection and analyses of samples with results and/or performance check procedures/methods summarized and documented in a field, personal, and/or instrument log notebook.
5. Analyte(s) identification
6. Field or laboratory determined method detection limits (MDLs) will be recorded along with corresponding analytical sample results, where appropriate.
7. Initial and continuous instrument calibration data.

For Screening Data with Definitive confirmation Objective:

The QA protocols for a screening data with definitive confirmation QA objective sampling event are applicable to all sample matrices and include:

**All QA requirements listed above and:**

8. Analytical error determination (Measure the precision of the analytical method, replicate and standard laboratory QC parameters, method-specific requirements specified in the QAPP).
9. Definitive Confirmation (At least 10 percent of the screening data must be confirmed with definitive data)

For Definitive project:

The QA protocols for a definitive data QA objective sampling event are applicable to all sample matrices and include:

**All QA levels requirements listed above and:**

10. Collection and analysis of blind field duplicate sample
11. Field blanks (for dedicated and non-dedicated equipment), rinse blanks (for non-dedicated equipment), and
12. Matrix Spike/Matrix Spike Duplicate (MS/MSD) QC samples to provide a quantitative measure of the analytical precision and accuracy, as applicable.
13. Performance Testing sample (project specified).

Definitive identification - confirm the identification of analytes on 100% of the “critical” samples, via an EPA-approved method; provide documentation such as gas chromatograms, mass spectra, etc.

The objective of this project/event applies to the following parameters:

**Table 1**  
**Quality Assurance Objectives**

<b>Analytical Parameters</b>	<b>Matrix</b>	<b>Intended Use of Data</b>	<b>QA Objective</b>
PCBs	Air	Verify presence or absence of PCBs in the air	Modified Definitive Data

A Field Sampling Summary is attached in Table 2 and a QA/QC Analysis and Objectives Summary is attached in Table 3. Subsection 5.1, Sampling Design, provides information on analyses to be performed on the samples.

**Table 2**  
**Field Sampling Summary**

Analytical Parameters	Matrix	Container Size	Preservative	Holding Time <sup>1</sup>	Subtotal Samples	Lot Blanks	Rinsate Blanks <sup>2</sup>	Field/Trip Blanks	Duplicate Samples <sup>3</sup>	MS/MSD Samples <sup>3</sup>	Total Field Samples
PCBs	Air	1.0um, 13mm, GF Filter plus Florisil <sup>®</sup> Tube	None	2 months for Florisil <sup>®</sup> Tubes <sup>5</sup>	Up to 100	1 per Lot	NR	1 per Shipment	1 per 20	NR	TBD

<sup>1</sup> Holding time from date of sampling.

<sup>2</sup> Only required if non-dedicated sampling equipment to be used.

<sup>3</sup> Additional volume will be collected for MS/MSD analyses.

<sup>4</sup> Total number of samples is approximate; samples will be collected throughout the project as directed by the OSC.

<sup>5</sup> As per NIOSH Manual of Analytical Methods, Method 5503.

NR - Not Required

*Refer to Attachment B for a list of EPA/ERT SOPs to be used.*

**Table 3**  
**QA/QC Analysis and Objectives Summary**

Analytical Parameters	Matrix	Analytical Method Reference	QA/QC Quantitation Limits	QA Objective
PCBs	Air	NIOSH Method 5503	As per method	Modified Definitive Data

Note: CLP-format deliverables required for all data packages.

## **5. APPROACH AND SAMPLING PROCEDURES**

In addition to the following, the approach and sampling procedures will be conducted in accordance with Sections B1 and B4 of the Region II RST 2 QAPP.

The following monitoring and sampling activities will be conducted at the Cornell-Dubilier Electronics Site:

- Perform real-time perimeter air monitoring for total particulate matter during all intrusive Site activities.
- Perform air sampling for PCBs during Site activities if the Site Specific Action Level for total particulate matter is exceeded.

This sampling design is based on information currently available and may be modified on-site in light of field-screening results and other acquired information. All deviations from the sampling plan will be noted in the Sampling Trip Report.

### **5.1 SAMPLING DESIGN**

A Field Sampling Summary is attached in Table 2 and a QA/QC Analysis and Objectives Summary is attached in Table 3. Table 3 provides information on analyses to be performed on the individual samples. The field program will consist of the collection of air samples. All sampling activities will be performed by the Region II RST 2, under the direction of the EPA OSC.

#### **Air Monitoring**

RST 2 will conduct real-time air monitoring for total particulate matter (total dust) during all intrusive Site activities using three Thermo DataRAM-DR4000 monitors. Two DataRAMs will be mounted on monitoring stations to be located downwind of the main work area of the Site for that monitoring period. The third DataRAM will be located upwind of the work area to collect control/background data. DataRAMs will be operated for a period of 6 to 7 hours a day, and will be biased towards the areas where maximum dust emissions may occur, for example where motorized equipment such as weed trimmers is being used. At the end of each day, the time-weighted average (TWA) and the maximum value (averaged every 10 seconds) for the day will be recorded and documented for each DataRAM. This data will be downloaded and a daily report will be generated. A graph will also be created based on the data collected for each day. Air monitoring data will be used to evaluate whether on-site dust suppression measures are sufficient using the action levels detailed below. The action level for evaluation of effective dust suppression is a TWA of  $0.15 \text{ mg/m}^3$ , based on the National Air Quality Standard (NAAQS) for particulates. The action level requiring an upgrade of PPE to Level C will be a TWA  $2.5 \text{ mg/m}^3$ , based on the OSHA Permissible Exposure Limit (PEL) for PCBs ( $0.5 \text{ mg/m}^3$ ) and a maximum PCBs soil concentration of  $180 \text{ mg/kg}$  in the soils/sediments following RST 2's sampling event in December 2007/January 2008.

Action Level	Method	Comment
TWA 0.15 mg/m <sup>3</sup>	Re-evaluate dust suppression controls	Based on NAAQS for PM <sub>10</sub>
TWA 0.50 mg/m <sup>3</sup>	Introduce Air Sampling for PCBS	Site Specific Action Level
TWA 2.5 mg/m <sup>3</sup>	Upgrade PPE to Level C	Site Specific Action Level

### **Air Sampling**

If the Site Specific Action Level for total particulate matter is exceeded, RST 2 will collect air samples for PCBs at three locations each day, or at the OSC's discretion. These monitoring stations will be co-located with the real-time air monitoring stations for total particulate matter. PCBs samples will be collected on a Florisil<sup>®</sup>-containing sampling medium preceded in line by a glass fiber filter. Both the Florisil<sup>®</sup> tube and the filter will be submitted for laboratory analysis. The PCB samples will be analyzed by NIOSH Method 5503, which can be found in Attachment C. SKC PCX R8 Universal Sample Pumps will be used to draw air through the sample media. Pumps will be calibrated before and after each sample run using a BIOS Dry Cal DC-Lite Electronic Flow Calibrator. The table below illustrates the flow rates and sample run-times that will be used by RST 2 during sampling. The sample volume will be calculated using the average of the pre-sampling and post-sampling flow rates. Sample run-times may fluctuate depending on the day to day work schedule.

Analyte	Method	Sample Medium	Flow Rate	Run-Time
PCBs	NIOSH 5503	1.0um, 13mm, GF Filter plus Florisil <sup>®</sup> Tube	0.1 L/min.	6 - 7 hours

## **5.2 SCHEDULE OF ACTIVITIES**

Proposed Start Date	Activity	End Date
10/14/08	Air Sampling/Air Monitoring	TBD

### **5.3 SAMPLING EQUIPMENT**

PCBs samples will be collected using 1.0um, 13mm, Glass Fiber (GF) Filters and Florisil® Tubes with SKC PCXR8 pumps. Particulate matter data will be collected using Thermo Scientific DataRAM 4 model DR-4000 Real-time Aerosol Monitors.

### **5.4 SAMPLE IDENTIFICATION SYSTEM**

Each sample collected by Region II RST 2 will be designated by a code that will identify the site. The code will be a site-specific project tracking number. The code for the Cornell-Dubilier Electronics Site is CDE. The media type will follow the numeric code. A hyphen will separate the site code and media type. Specific media types are as follows:

A – Air  
FB – Field Blank  
LB – Lot Blank

After the media type, the sequential sample numbers will be listed; for example CDE-A-01 will be the first air sample taken. A duplicate sample will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

### **5.5 STANDARD OPERATING PROCEDURES (SOPs)**

#### **5.5.1 SAMPLE DOCUMENTATION**

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

#### Field Logbook

The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following:

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description \*

9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches

\* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

#### Sample Labels

Sample labels will clearly identify the particular sample, and should include the following:

1. Site/project number.
2. Sample identification number.
3. Sample collection date and time.
4. Designation of sample (grab or composite).
5. Sample preservation.
6. Analytical parameters.
7. Name of sampler.

Sample labels will be written in indelible ink and securely affixed to the sample container.

#### Custody Seals

Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

### **5.5.2 SAMPLING SOPs**

The following SOPs will be used for this project.

#### Air Sampling

- EPA/ERT SOP #2008 - General Air Sampling Guideline (Attachment B)
- NIOSH 5503 - Polychlorobiphenyls (Attachment C)

### **5.5.3 SAMPLE HANDLING AND SHIPMENT**

Each of the sample bottles will be sealed and labeled according to the following protocol. Caps will be secured with custody seals. Bottle labels will contain all required information including site/project code and sample number, time and date of collection, analyses requested, and preservative used. Sealed bottles will be placed in large metal or plastic coolers, and padded with an absorbent material such as vermiculite. All packaging will conform to IATA transportation regulations for overnight carriers.



All sample documents will be sealed in a plastic bag and affixed to the underside of each cooler lid. The lid will be sealed and affixed on at least two sides with custody seals so that any sign of tampering is easily visible.

## **5.6 SAMPLE CONTAINERS**

All sample containers will meet the QA/QC specifications in OSWER Directive 9240.0-05A, "Specifications and Guidance for Contaminant Free Sample Containers."

## **5.7 DISPOSAL OF PPE AND CONTAMINATED SAMPLING MATERIALS**

All used PPE and disposable sampling equipment will be disposed of during the on going removal action.

## **6. SAMPLE CUSTODY**

In addition to the following, the sample custody procedure will be conducted in accordance with Section B3 of the Region II RST 2 QAPP.

A chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook.

The chain-of-custody record should include (at minimum) the following:

1. Sample identification number
2. Sample information
3. Sample location
4. Sample date
5. Name(s) and signature(s) of sampler(s)
6. Signature(s) of any individual(s) with custody of samples

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

## **7. FIELD INSTRUMENT CALIBRATION AND PREVENTIVE MAINTENANCE**

In addition to the following, the field instrument and preventative maintenance procedure will be conducted in accordance with Section B6 of the Region II RST 2 QAPP.

The sampling team is responsible for ensuring that a calibration/maintenance log will be brought

into the field and maintained for each measuring device. Each log will include at a minimum, where applicable:

- Name of device and/or instrument calibrated.
- Device/instrument serial and/or ID number.
- Frequency of calibration.
- Date of calibration.
- Results of calibration.
- Name of person performing the calibration.
- Identification of the calibrant.

Equipment to be used each day will be calibrated prior to the commencement of daily activities.

## **8. ANALYTICAL METHODS**

Analytical methods to be utilized in the analyses of samples collected during this sampling event are detailed in Table 3.

## **9. DATA REDUCTION, VALIDATION, AND REPORTING**

In addition to the following, the data reduction, validation, and reporting procedure will be conducted in accordance with Sections D1, D2, and D3 of the Region II RST 2 QAPP.

### **9.1 DELIVERABLES**

The RST 2 SPM, Matt Foster, will maintain contact with the EPA OSC James Kearns, to keep him informed about the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

#### Trip Report

A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within 1 week of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

#### Maps/Figures

Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

### Analytical Report

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

### Data Review

A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

## **9.2 DATA VALIDATION**

Data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform-Federal Policy for Implementing Quality System: Part B: Quality Control/Quality Assurance Compendium: Minimum QA/QC Activities; the CLP Functional Guidelines for Organic and Inorganic Data Review, and Region 2 Data Validation SOPs.

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

## **10. FIELD QUALITY CONTROL CHECKS AND FREQUENCY**

In addition to the following, the field quality control checks and frequency procedure will be conducted in accordance with Section B7 of the Region II RST 2 QAPP.

This section details the QA/QC requirements for field activities performed during the sampling effort.

QA/QC samples will include the collection of one field duplicate at a ratio of 1 per 20 samples. Field duplicate samples provide an indication of analytical variability and analytical error and will not be identified to the laboratory.

Blanks will be collected for all parameters of interest (excluding physical parameters) and shipped with the samples collected the same day.

## **11. SYSTEM AUDITS**

In addition to the following, the system audit procedure will be conducted in accordance with Section C1 of the Region II RST 2 QAPP.

The Field QA/QC Officer will observe sampling operations and review subsequent analytical results to ensure compliance with the QA/QC requirements of the project/sampling event.

## **12. CORRECTIVE ACTION**

In addition to the following, the corrective action procedure will be conducted in accordance

with Section C1 of the Region II RST 2 QAPP.

All provisions will be taken in the field and laboratory to ensure that any problems that may develop will be dealt with as quickly as possible to ensure the continuity of the project/sampling events. Any deviations from this sampling plan will be noted in the Sampling Trip Report.

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**ATTACHMENT A**

**SITE MAPS**

---



**DRAFT**



Former Location of  
Cornell-Dubilier Buildings

Commerical

New Market

Commerical

Note:  
100-year floodplains derived  
from Flood Insurance Rate Map  
of South Plainfield, NJ.  
Flood Hazard Area Limit  
derived from NJDEP  
Delineation of Floodway  
and Flood Hazard Area for  
Bound Brook. 100 -year  
Flood and Flood Hazard  
Area Limit is at 72 feet  
above mean sea level.

Note:  
Map adapted from an existing map created  
by the Foster Wheeler Environmental Corporation  
titled, "Vegetation Cover Types and Habitats  
Observed on the Undeveloped Portion  
Cornell- Dubilier Electronics Superfund Site  
On-Site Soils and Building RI Report".  
Date Created : (05/08/01)

Spicer

Residential

Residential

Existing  
Double  
Culvert

Existing  
Single Culvert

Approximate Location  
Of Existing Fence  
To Be Mended

Approximate Area To Be Cleared,  
Covered With Geotextile Fabric  
And Rip-Rap

Existing  
Fence

**Legend**

- |                     |                                   |                               |                    |
|---------------------|-----------------------------------|-------------------------------|--------------------|
| 100 Year Floodplain | Facility Property Boundary Limits | Geotextile Area               | Successional Field |
| Bound Brook         | Paved Area                        | Wetland Boundary Limits       | Rail Road          |
|                     |                                   | Broad Leaved Deciduous Forest | Culvert            |
|                     |                                   |                               | Fence              |

**Stream Bank/ Wetlands Erosion Control Plan  
Cornell- Dubilier Electronics Superfund Site**



**Weston Solutions, Inc.**

In Association With  
Avatar Environmental, LLC,  
Innovative Technical Solutions, Inc.  
and Scientific and Environmental Associates, Inc.

**Figure 1  
Erosion Control Plan**

CORNELL-DUBILIER SITE PLAINFIELD, NEW JERSEY	
U.S. ENVIRONMENTAL PROTECTION AGENCY REMOVAL SUPPORT TEAM CONTRACT # EP-W-06-072	
DRAWN BY:	J. JAGER
EPA OSC:	J. KEARNS
RST SPM:	J. BRENNAN
FILENAME:	CORNELL-DUBILIER.MXD



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**ATTACHMENT B**

**EPA/ERT SAMPLING SOPS**

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## GENERAL AIR SAMPLING GUIDELINES

SOP#: 2008  
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### 1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) provides guidance in developing and implementing sampling plans to assess the impact of hazardous waste sites on ambient air. It presents the United States Environmental Protection Agency/Environmental Response Team's (U.S. EPA/ERT's) approach to air sampling and monitoring and identifies equipment requirements. It is not within the scope of this SOP to provide a generic air sampling plan. Experience, objectives, site characteristics, and chemical characteristics will dictate sampling strategy. This SOP does not address indoor air sampling.

Two basic approaches can be used to assess ambient air (also referred to as air pathway assessments): modeling and measurements. The modeling approach initially estimates or measures the overall site emission rate(s) and pattern(s). These data are input into an appropriate air dispersion model, which predicts either the maximum or average air concentrations at selected locations or distances during the time period of concern. This overall modeling strategy is presented in the first three volumes of the Air Superfund National Technical Guidance Series on Air Pathway Assessments<sup>(1,2,3)</sup>. Specific applications of this strategy are presented in several additional Air Superfund Technical Guidance documents<sup>(4)</sup>.

The measurement approach involves actually measuring the air impact at selected locations during specific time periods. These measurements can be used to document actual air impacts during specific time intervals (i.e., during cleanup operations) or to extrapolate the probable "worst case" concentrations at that and similar locations over a longer time period than was sampled.

This SOP addresses issues associated with this second assessment strategy. This SOP also discusses the U.S. EPA/ERT's monitoring instruments, air sampling

kits, and approach to air sampling and monitoring at hazardous waste sites.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, depending on site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

### 2.0 METHOD SUMMARY

*Air monitoring* is defined as the use of direct-reading instruments and other screening or monitoring equipment and techniques that provide instantaneous (real-time) data on the levels of airborne contaminants. The U.S. EPA/ERT maintains numerous monitors for real-time measurements. Examples of air monitoring equipment are hand-held photoionization detectors (PID), flame ionization detectors (FID), oxygen/combustible gas detectors, and remote optical sensors.

*Air sampling* is defined as those sampling and analytical techniques that require either off- or on-site laboratory analysis and therefore do not provide immediate results. Typically, air sampling occurs after use of real-time air monitoring equipment has narrowed the number of possible contaminants and has provided some qualitative measurement of contaminant concentration. Air sampling techniques are used to more accurately detect, identify and quantify specific chemical compounds relative to the majority of air monitoring technologies.

In the Superfund Removal Program, On-Scene Coordinators (OSCs) may request the U.S. EPA/ERT to conduct air monitoring and sampling during the



following situations: emergency responses, site assessments, and removal activities. Each of these activities has a related air monitoring/sampling objective that is used to determine the potential hazards to workers and/or the community.

**C Emergency Response**

Emergency responses are immediate responses to a release or threatened release of hazardous substances presenting an imminent danger to public health, welfare, or the environment (i.e., chemical spills, fires, or chemical process failures resulting in a controlled release of hazardous substances). Generally these situations require rapid on-site investigation and response. A major part of this investigation consists of assessing the air impact of these releases.

**C Removal Site Assessment**

Removal site assessments (referred to as site assessments) are defined as any of several activities undertaken to determine the extent of contamination at a site and which help to formulate the appropriate response to a release or threatened release of hazardous substances. These activities may include a site inspection, multimedia sampling, and other data collection.

**C Removal Actions**

Removal actions clean up or remove hazardous substances released into the environment. Removal actions include any activity conducted to abate, prevent, minimize, stabilize, or eliminate a threat to public health or welfare, or to the environment.

Personal risk from airborne contaminants can be determined by comparing the results of on-site monitoring and sampling to health-based action levels such as the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). Residential risk can be determined by comparing the results of off-site monitoring or sampling to health-based action levels such as those developed by the Agency for Toxic Substance and

Disease Registry (ATSDR).

The extent to which valid inferences can be drawn from air monitoring/sampling depends on the degree to which the monitoring/sampling effort conforms to the objectives of the event. Meeting the project's objectives requires thorough planning of the monitoring/sampling activities, and implementation of the most appropriate monitoring/sampling and analytical procedures. These issues will be discussed in this SOP.

### **3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE**

Preservation, containers, handling and storage for air samples are discussed in the specific SOPs for the technique selected. In addition, the analytical method (i.e., U.S. EPA, National Institute for Occupational Safety and Health [NIOSH], and OSHA Methods) may be consulted for storage temperature, holding times and packaging requirements. After sample collection, the sampling media (i.e., cassettes or tubes) are immediately sealed. The samples are then placed into suitable containers (i.e., whirl bags, resealable bags or culture tubes) which are then placed into a shipping container.

Use bubble wrap or styrofoam peanuts when packing air samples for shipment. DO NOT USE VERMICULITE.

### **4.0 INTERFERENCES AND POTENTIAL PROBLEMS**

Upwind sources can contribute to sample concentration. Natural sources, such as biological waste, can produce hydrogen sulfide and methane which may contribute to the overall contaminant level. Extraneous anthropogenic contaminants (i.e., burning of fossil fuels; emissions from vehicular traffic, especially diesel; volatile compounds from petrochemical facilities; and effluvium from smoke stacks) may also contribute. Air sampling stations should be strategically placed to identify contributing sources.

Photoreactivity or reaction of the parameters of concern may occur with nonrelated compounds [i.e., nitrogen compounds and polyaromatic hydrocarbons

(PAHs)]. Some sorbent media/samples should not be exposed to light during or after sampling due to photochemical effects (i.e., PAHs).

Various environmental factors, including humidity, temperature and pressure, also impact the air sampling methodology, collection efficiency and detection limit. Since the determination of air contaminants is specifically dependent on the collection parameters and efficiencies, the collection procedure is an integral part of the analytical method.

Detection limits depend on the contaminants being investigated and the particular site situation. It is important to know why the data are needed and how the data will be used. Care should be taken to ensure the detection limits are adequate for the intended use of the final results.

Some equipment may be sensitive to humidity and temperature extremes.

## **5.0 EQUIPMENT/APPARATUS**

### **5.1 Direct Reading Instruments (Air Monitoring Instruments)**

There are two general types of direct reading instruments: portable screening devices and specialized analytical instruments. Generally all these techniques involve acquiring, for a specific location or area, continuous or sequential direct air concentrations in either a real-time or semi-real-time mode. None of these instruments acquires true time-weighted average concentrations. In addition, these instruments are not capable of acquiring simultaneous concentration readings at multiple locations, although several are able to sequentially analyze samples taken remotely from different locations. The document, "Guide to Portable Instruments for Assessing Airborne Pollutants Arising from Hazardous Waste Sites<sup>(5)</sup>," provides additional information about air sampling and monitoring. The hazard levels for airborne contaminants vary. See the ACGIH TLVs and the OSHA PELs for safe working levels. Common screening devices and analytical instruments are described in Appendix A.

### **5.2 Air Sampling Equipment and Media/Devices**

The U.S. EPA/ERT uses the following analytical

methods for sampling: *NIOSH Manual of Analytical Methods*<sup>(6)</sup>, *American Society for Testing and Materials (ASTM) Methods*<sup>(7)</sup>, *U.S. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*<sup>(8,9)</sup>, and *OSHA Methods*<sup>(10)</sup>. Additional air sampling references include *Industrial Hygiene and Toxicology* (3rd Ed.)<sup>(11)</sup> and *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*<sup>(12)</sup>. These methods typically specify equipment requirements for sampling. Since air sampling is such a diverse technology, no single method or reference is best for all applications. Common sampling equipment and media/devices are described in Appendix B.

### **5.3 Tools/Material and Equipment List**

In addition to equipment and materials identified in Appendices A and B, the following equipment and materials may be required to conduct air sampling and monitoring at hazardous waste sites:

- C Camera
- C Site logbook
- C Clipboard
- C Chain of custody records
- C Custody seals
- C Air sampling worksheets
- C Sample labels
- C Small screwdriver set
- C Aluminum foil
- C Extension cords
- C Glass cracker
- C Multiple plug outlet
- C Whirl bags or culture tubes
- C Teflon tape
- C Calibration devices
- C Tygon and/or Teflon<sup>R</sup> tubing
- C Surgical gloves
- C Lint-free gloves
- C Ice
- C Sample container

Use the following additional equipment when decontaminating glassware on site:

- C Protective equipment (i.e., gloves, splash goggles, etc.)
- C Appropriate solvent(s)
- C Spray bottles
- C Liquinox (soap)
- C Paper towels

- C Distilled/deionized water
- C Five-gallon buckets
- C Scrub brushes and bottle brushes

## 6.0 REAGENTS

Impinger sampling involves using reagents contained in a glass vial to absorb contaminants of concern (for example, NIOSH Method 3500 for formaldehyde uses 1% sodium bisulfite solution). Impinger solutions vary and are method-dependent.

Reagents such as acetone and hexane are required to decontaminate glassware and some air sampling equipment. Decontamination solutions are specified in the Sampling Equipment Decontamination SOP.

## 7.0 PROCEDURES

### 7.1 Air Monitoring Design

#### 7.1.1 Initial Surveys

In general, the initial survey is considered to be a relatively rapid screening process for collecting preliminary data at hazardous waste sites. However, initial surveys may require many hours to complete and may consist of more than one entry.

Some information is generally known about the site; therefore, real-time instrumentation for specific compounds (i.e., detector tubes and electrochemical sensors) can be used to identify hot spots. Sufficient data should be obtained with real-time instruments during the initial entry to screen the site for various contaminants. When warranted, intrinsically safe or explosion-proof instruments should be used. An organic vapor analyzer (OVA) is typically used during this survey. These gross measurements may be used on a preliminary basis to (1) determine levels of personal protection, (2) establish site work zones, and (3) map candidate areas for more thorough qualitative and quantitative studies involving air sampling.

In some situations, the information obtained may be sufficient to preclude additional monitoring. Materials detected during the initial survey may call for a more comprehensive evaluation of hazards and analyses for specific compounds. Since site activities and weather conditions change, a continuous program to monitor the ambient atmosphere must be established.

### 7.1.2 Off-Site Monitoring

Typically, perimeter monitoring with the same instruments employed for on-site monitoring is utilized to determine site boundaries. Because air is a dynamic matrix, physical boundaries like property lines and fences do not necessarily delineate the site boundary or area influenced by a release. Whenever possible, atmospheric hazards in the areas adjacent to the on-site zone should be monitored with direct-reading instruments. Monitoring at the fenceline or at varying locations off site provides useful information regarding pollutant migration. Three to four locations downwind of the source (i.e., plume) at breathing-zone height, provide a basic fingerprint of the plume. Negative instrument readings off site should not be interpreted as the complete absence of airborne toxic substances; rather, they should be considered another piece of information to assist in the preliminary evaluation. The interpretation of negative readings is instrument-dependent. The lack of instrument readings off site should not be interpreted as the complete absence of all airborne toxic substances; rather, it is possible that the particular compound or class of compounds to which the monitoring instrument responds is not present or that the concentration of the compound(s) is below the instrument's detection limit.

### 7.2 Air Sampling Design

#### 7.2.1 Sampling Plan Design

The goal of air sampling is to accurately assess the impact of a contaminant source(s) on ambient air quality. This impact is expressed in terms of overall average and/or maximum air concentrations for the time period of concern and may be affected by the transport and release of pollutants from both on- and off-site sources. The location of these sources must be taken into account as they impact the selection of sampling locations. Unlike soil and groundwater concentrations, air concentrations at points of interest can easily vary by orders of magnitude over the period of concern. This variability plays a major role in designing an air sampling plan.

Downwind air concentration is determined by the amount of material being released from the site into the air (the emission rate) and by the degree that the contamination is diluted as it is transported. Local

meteorology and topography govern downwind dilution. Contaminant emission rates can also be heavily influenced by on-site meteorology and on-site activities. All of these concerns must be incorporated into an air sampling plan.

A sampling strategy can be simple or complex, depending on the sampling program objectives. Programs involving characterization of the pollutant contribution from a single point source tend to be simple, whereas sampling programs investigating fate and transport characteristics of components from diverse sources require a more complex sampling strategy. In addition, resource constraints may affect the complexity of the sampling design.

An optimal sampling strategy accounts for the following site parameters:

- C Location of stationary as well as mobile sources
- C Analytes of concern
- C Analytical detection limit to be achieved
- C Rate of release and transport of pollutants from sources
- C Availability of space and utilities for operating sampling equipment
- C Meteorological monitoring data
- C Meteorological conditions in which sampling is to be conducted

The sampling strategy typically requires that the concentration of contaminants at the source or area of concern as well as background contributions be quantified. It is important to establish background levels of contaminants in order to develop a reference point from which to evaluate the source data. Field blanks and lot blanks, as well as various other types of QA/QC samples, can be utilized to determine other sources. The impact of extraneous sources on sampling results can frequently be accounted for by placing samplers upwind, downwind and crosswind from the subject source. The analytical data from these different sampling locations may be compared to determine statistical differences.

## 7.2.2 Sampling Objectives

The objectives of the sampling must be determined prior to developing the sampling plan. Does the sampling plan verify adequate levels of protection for on-site personnel, or address potential off-site impacts

associated with the site or with site activities? In addition, the assumptions associated with the sampling program must be defined. These assumptions include whether the sampling is to take place under "typical," "worst case," or "one-time" conditions. If the conditions present at the time of sampling are different from those assumed during the development of the sampling plan, then quality of the data collected may be affected. The following definitions have been established:

- C Typical: routine daily sampling or routine scheduled sampling at pre-established locations.
- C Worst case: sampling conducted under the worst meteorological and/or site conditions which would result in elevated ambient concentrations.
- C One-time: only one chance is given to collect a sample without regard to time or conditions.

Qualitative data acquired under these conditions are usually applicable only to the time period during which the data were collected and may not provide accurate information to be used in estimating the magnitude of an air impact during other periods or over a long time interval.

The sampling objectives also dictate the detection limits. Sampling methods for airborne contaminants will depend upon the nature and state (solid, liquid or gas) of the contaminant. Gases and vapors may be collected in aqueous media or adsorbents, in molecular sieves, or in suitable containers. Particulates are collected by filters or impactors. The volume of sample to be collected is dependent upon an estimate of the contaminant concentration in the air, the sensitivity of the analytical method, and the standard or desired detection limit. A sufficient amount of sample must be collected to achieve the desired detection limit without interference from other contaminants. In addition, the selected method must be able to detect the target compound(s).

### 7.2.3 Location and Number of Individual Sampling Points

Choose the number and location of sampling points according to the variability, or sensitivity, of the sampling and analytical methods being utilized, the variability of contaminant concentration over time at the site, the level of precision required and cost limitations. In addition, determine the number of locations and placement of samplers by considering the nature of the response, local terrain, meteorological conditions, location of the site (with respect to other conflicting background sources), size of the site, and the number, size, and relative proximity of separate on-site emission sources and upwind sources. The following are several considerations for sampler placement:

- C Location of potential on-site emission sources, as identified from the review of site background information or from preliminary on-site inspections.
- C Location of potential off-site emission sources upwind of the sampling location(s). Review local wind patterns to determine the location of off-site sources relative to wind direction.

- C Topographic features that affect the dispersion and transport of airborne toxic constituents.

Avoid natural obstructions when choosing air sampling station locations, and account for channelization around those obstructions.

- C Large water bodies, which affect atmospheric stability and the dispersion of air contaminants.
- C Roadways (dirt or paved), which may generate dust that could mask site contaminants.
- C Vegetation, such as trees and shrubs, which stabilizes soil and retards subsurface contaminants from becoming airborne. It also affects air flow and scrubs some contaminants from the air. Sometimes thick vegetation can make an otherwise ideal air monitoring location inaccessible.

Consider the duration of sampling activities when choosing the location and number of samples to be collected. For example, if the sampling period is limited to a few hours, one or two upwind and several downwind samples would typically be adequate, especially around major emission sources.

A short-term monitoring program ranges from several days to a few weeks and generally includes gathering data for site assessments, removal actions, and source determination data (for further modeling). Activities involved in a short-term sampling strategy must make the most of the limited possibilities for data collection. Consider moving upwind/downwind locations daily based on National Oceanic and Atmospheric Administration (NOAA) weather forecasts. Weather monitoring becomes critical where complex terrain and local meteorological effects frequently change wind direction. Often, a number of alternatives can fulfill the same objective.

Prevailing winds running the length of a valley usually require a minimum number of sampler locations; however, a complex valley may require more sampler locations to account for the wide variety of winds. Ocean/lake effects may require a radical plan to collect enough samples to reach a low detection limit. Two sets of samplers may be placed next to each other: one set would be activated during the sea breeze

while the other set is turned off, and vice versa when there is no sea breeze. After the sampling event, the respective upwind and downwind samples would be combined. Another alternative for sampling near a large body of water may be to use automatic, wind-vector-operated samplers, which turn the sampler on only when the wind comes from a specified vector. At sites located on hillsides, wind will move down a valley and produce an upward fetch at the same time. Sampling locations may have to ring the site to measure the wind's impact.

Off-site sources may affect on-site monitoring. In this case, on-site meteorological data, concurrent with sampling data, is essential to interpreting the acquired data. Also, additional upwind sampling sites may be needed to fully characterize ambient background contaminant levels. Multiple off-site sources may require several monitoring locations, but if the sources are at a sufficient distance, only one monitoring location is needed.

Topography and weather are not the only factors in sampler location; the sampling sites must be secure from vandals and mishap. Secure all sampling locations to maintain chain of custody, and to prevent tampering with samples or loss of sampling units. High-volume sampling methods often require the use of 110 VAC electric power. When portable generators are used, the power quality may affect sampler operation. Also, be aware that the generators themselves could be a potential pollution source if their placement is not carefully considered.

Air quality dispersion models can be used to place samplers. The models incorporate source information, surrounding topography, and meteorological data to predict the general distance and directions of maximum ambient concentrations. Modeling results should be used to select sampling locations in areas of maximum pollutant concentrations.

#### 7.2.4 Time, Duration and Frequency of Sampling Events

After choosing appropriate sampling or monitoring locations, determine the sampling frequency and the number of samples to be collected. The time of day, duration and frequency of sampling events is governed by:

- C The effects of site activities and meteorology

on emission rates

- C The diurnal effect of the meteorology on downwind dispersion
- C The time period(s) of concern as defined by the objective
- C The variability in the impact from other non-site-related sources
- C If defined, the degree of confidence needed for either the mean or maximum downwind concentrations observed
- C The precision requirements for single measurements
- C Cost and other logistical considerations

The duration of the removal action and the number of hours per day that site work is conducted determine the time, duration, and frequency of samples. Short-term sampling programs may require daily sampling, while long-term programs may require 24-hour sampling every sixth or twelfth day. If the site will be undergoing removal activities 24 hours a day, continuous air sampling may be warranted. However, if the site activities will be conducted for only eight hours a day, and there are no emissions likely to occur during the remaining 16 hours, then sampling would be appropriate prior to the start of daily activities, would continue during operations, and end at the conclusion of the daily activities. An off-peak sample collection can ensure that emissions are not persisting after the conclusion of daily cleanup activities. For some sites, emissions are still a factor several hours after daily site activities have been completed. Because of the typically decreased downwind dispersion in the evening, higher downwind concentrations than were present during daytime site activities may be detected. For sites where this is possible, the sampling duration needs to be lengthened accordingly.

Sampling duration and flow rate dictate the volume of air collected, and to a major degree, the detection limit. The analytical method selected will provide a reference to flow rate and volume. Flow rates are limited to the capacity of the pumps being employed and the contact time required by the collection media.

The duration or period of air sampling is commonly divided into two categories (1) samples collected over a brief time period are referred to as "instantaneous" or "grab" samples and are usually collected in less than five minutes and (2) average or integrated samples are collected over a significantly longer period of time. Integrated samples provide an average

concentration over the entire sampling period. Integrated samples are not suited to determining cyclical releases of contaminants because periodic or cyclical events are averaged out by the proportionally long sampling duration.

Air quality dispersion models can predict the maximum air contaminant concentration expected from a source. The meteorological and site conditions expected to cause the highest concentration are known as worst-case conditions and can be identified by analyzing the modeling results. Depending upon the objective, one may sample when the model predicts worst-case conditions will exist.

## 7.2.5 Meteorological and Physical/Chemical Considerations

A meteorological monitoring program is an integral part of site monitoring activities. Meteorological data, which define local terrain impacts on air flow paths, are needed to interpret air concentration data. Meteorological data may be available from an existing station located near the site (i.e., at a local airport), otherwise a station should be set up at the site. This data will document the degree that samples actually were downwind and verify whether other worst-case assumptions were met. Meteorological parameters to be monitored are, at a minimum, wind speed, wind direction, and sigma theta (which is the horizontal wind direction standard deviation and an indicator of atmospheric stability). The remaining parameters primarily affect the amount of a contaminant available in the air.

### C Wind Speed

When the contaminant of concern is a particulate, wind speed is critical in determining whether the particulate will become airborne, the quantity of the particulate that becomes airborne, and the distance the particulate will travel from the source. Wind speed also contributes to the volatilization of contaminants from liquid sources.

### C Wind Direction

Wind direction highly influences the path of airborne contaminants. In addition, variations in wind direction increase the

dispersion of pollutants from a given source.

### C Atmospheric Stability

Atmospheric stability refers to the degree to which the atmosphere tends to dampen vertical and horizontal motion. Stable atmospheric conditions (i.e., evenings) result in low dispersion, and unstable atmospheric conditions (i.e., hot sunny days) result in higher dispersion.

### C Temperature

Higher temperatures increase the rate of volatilization of organic and some inorganic compounds and affect the initial rise of gaseous or vapor contaminants. Therefore, worst-case emission of volatiles and semivolatiles occurs at the hottest time of day, or on the hottest day.

### C Humidity

High humidity affects water-soluble chemicals and particulates. Humid conditions may dictate the sampling media used to collect the air sample, or limit the volume of air sampled and thereby increase the detection limit.

### C Atmospheric Pressure

Migration of landfill gases through the landfill surface and through surrounding soils are governed by changes in atmospheric pressure. Atmospheric pressure will influence upward migration of gaseous contaminants from shallow aquifers into the basements of overlying structures.

In many cases, the transport and dispersion of air pollutants is complicated by local meteorology. Normal diurnal variations (i.e., temperature inversions) affect dispersion of airborne contaminants. Terrain features can enhance or create air inversions and can also influence the path and speed of air flow, complicating transport and dispersion patterns.

The chemical characteristics of a contaminant (i.e., molecular weight, physical

state, vapor pressure, aerodynamic size, temperature, reactive compounds, and photodegradation) affects its behavior and can influence the method used to sample and analyze it.

## **8.0 CALCULATIONS**

Volume is obtained by multiplying the sample time in minutes by the flow rate. Sample volume should be indicated on the chain of custody record. Adjustments for temperature and pressure differences may be required.

Results are usually provided in parts per million (ppm), parts per billion (ppb), milligrams per cubic meter (mg/m<sup>3</sup>) or micrograms per cubic meter (µg/m<sup>3</sup>).

Refer to the analytical method or regulatory guidelines for other applicable calculations.

## **9.0 QUALITY ASSURANCE/ QUALITY CONTROL**

The manufacturer's instructions should be reviewed prior to instrument use. Instruments must be utilized in accordance with manufacturer's instructions. Equipment checkout and calibration activities must occur prior to and after monitoring and sampling and must be documented.

### **9.1 QA/QC Samples**

QA/QC samples provide information on the variability and usability of environmental sample results. Various QA/QC samples may be collected to detect error. QA/QC samples are submitted with the field samples for analysis to aid in identifying the origin of analytical discrepancies; then a determination can be made as to how the analytical results should be used. Collocated samples, background samples, field blanks, and lot blanks are the most commonly collected QA/QC field samples. Performance evaluation (PE) samples and matrix spikes provide additional measures of data QA/QC control. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet site-specific QA or data quality objectives.

### **9.2 Sample Documentation**

All sample and monitoring activities should be documented legibly, in ink. Any corrections or revisions should be made by lining through the incorrect entry and by initialing the error. All samples must be recorded on an Air Sampling Worksheet. A chain of custody record must be maintained from the time a sample is taken to the final deposition of the sample. Custody seals demonstrate that a sample container has not been opened or tampered with during transport or storage of samples.

## **10.0 DATA VALIDATION**

Results for QA/QC samples should be evaluated for contamination. This information should be utilized to qualify the environmental sample results accordingly with data quality objectives.

## **11.0 HEALTH AND SAFETY**

Personal protection equipment (PPE) requirements identified in federal and/or state regulations and 29 Code of Federal Regulations (CFR) 1910.120 for hazardous waste site work must be followed.

The majority of physical precautions involved in air sampling are related to the contaminant sampled. Attention should be given when sampling in potentially explosive, flammable or acidic atmospheres. On rare occasions, the collection media may be hazardous; for example, in the instance where an acidic or basic solution is utilized in an impinger.

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures.

## **12.0 REFERENCES**

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## APPENDIX A

## Portable Screening Devices and Specialized Analytical Instruments

### PORTABLE SCREENING DEVICES

Where possible, a datalogger should be used to minimize the length of time required for site personnel to be in a potentially contaminated area. Datalogger cable is available from manufacturers for linear output instruments and some nonlinear output instruments. U.S. EPA ERT/REAC has output cables for organic vapor analyzers (i.e., HNU and OVA), toxic gas analyzers (i.e., monitox) and real-time aerosol monitors (i.e., RAM and miniram).

#### C Total Hydrocarbon Analyzers

Total hydrocarbon analyzers used to detect a variety of volatile organic compounds (VOCs) at hazardous waste sites principally employ either a photoionization detector (PID) or a flame ionization detector (FID). Compounds are ionized by a flame or an ultraviolet lamp. PIDs depend on the ionization potential of the compounds. PIDs are sensitive to aromatic and olefinic (unsaturated) compounds such as benzene, toluene, styrene, xylenes, and acetylene. Greater selectivity is possible by using low-voltage lamps. The ionization potential of individual compounds can be found in the NIOSH Pocket Guide to Chemical Hazards. These instruments are not compound-specific and are typically used as screening instruments. FIDs are sensitive to volatile organic vapor compounds such as methane, propanol, benzene and toluene. They respond poorly to organic compounds lacking hydrocarbon characteristics.

#### C Oxygen and Combustible Gas Indicators

Combustible Gas Indicators (CGIs) provide efficient and reliable methods to test for potentially explosive atmospheres. CGI meters measure the concentration of a flammable vapor or gas in air and present these measurements as a percentage of the lower explosive limit (LEL).

The measurements are temperature-dependent. The

property of the calibration gas determines sensitivity.

LELs for individual compounds can be found in the NIOSH Pocket Guide to Chemical Hazards. If readings approach or exceed 10% of the LEL, extreme caution should be exercised in continuing the investigation. If readings approach or exceed 25% LEL, personnel should be withdrawn immediately.

CGIs typically house an electrochemical sensor to determine the oxygen concentration in ambient air. Normally, air contains approximately 20.9% oxygen by volume. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of accidents that have produced heavier-than-air vapors which could displace ambient air. The meters are calibrated for sea level and may indicate a false negative (i.e., O<sub>2</sub> content) at higher altitudes. Since the air has been displaced by other substances, these oxygen-deficient areas are also prime locations for taking additional organic vapor and combustible gas measurements. Oxygen-enriched atmospheres increase the potential for fires by their ability to contribute to combustion or to chemically react with flammable compounds and promote auto-ignition.

#### C Toxic Atmosphere Analyzers

The toxic atmosphere analyzer is a compound-specific instrument, designed and calibrated to identify and quantify a specific compound or class of compounds in either gaseous or vapor form. Cross-sensitivity to air pollutants not of interest may lead to erroneous results.

U.S. EPA/ERT has the following toxic atmosphere analyzers: carbon monoxide, phosgene, nitrous oxide, hydrogen cyanide, sulfur dioxide, hydrogen sulfide, and chlorine gas.

## C Aerosol/Particulate Monitors

A Real-Time Aerosol/Particulate Monitor (RAM) displays readings for total particulates. The instrument employs a pulse light emitting diode which generates a narrow band emission in conjunction with a photovoltaic cell to detect light scattered from particulates.

The U.S. EPA/ERT uses the RAM when the contaminant of concern is associated with particulates, and when responding to fires involving hazardous materials, to identify plume levels. The instrument is very useful in determining the presence of a plume when it is not visible. The U.S. EPA/ERT typically uses RAMs on tripods to obtain particulate concentrations at the breathing zone level. Personal dataloggers are used with the RAMs to document minimum, average and maximum concentrations. This provides real-time data without requiring those in personal protective equipment to be constantly present in the plume.

## C Chemical Detector Tubes (Colorimetric Tubes)

A chemical detector tube is a hollow, tube-shaped, glass body containing one or more layers of chemically impregnated inert material. To use, the fused ends are broken off and a manufacturer-specified volume of air is drawn through the tube with a pump to achieve a given detection limit. The chemicals contained within the packing material undergo a chemical reaction with the airborne pollutant present, producing a color change during the intake of each pump stroke. The concentration of a pollutant is indicated by the length of discoloration on a calibrated scale printed on the detector tube.

## C Radiation Meters

Radiation meters determine the presence and level of radiation. The meters use a gas or solid ion detection media which becomes ionized when radiation is present. The meters are normally calibrated to one probe. Meters that detect alpha, beta, and gamma radiation are available.

C Gold Film (Hydrogen Sulfide and Mercury Vapor) Monitors

Hydrogen sulfide (H<sub>2</sub>S) and Mercury (Hg) monitors operate on the principle that electric resistivity increases across a gold film as a function of H<sub>2</sub>S and Hg concentration. The monitors provide rapid and relatively low detection limits for H<sub>2</sub>S and Hg in air. After extensive sampling periods or high concentrations of H<sub>2</sub>S and Hg, the gold film must be heated to remove contamination and return the monitor to its original sensitivity.

C Infrared Detectors

Infrared detectors such as the Miniature Infrared Analyzer (MIRAN) use infrared (IR) absorption as a function of specific compounds. MIRAN instruments apply to situations where the contaminants are identified but concentrations are not. MIRAN instruments generally require AC power.

C Remote Optical Sensing

This technique, also referred to as long-path or open-path monitoring, involves transmitting either an infrared or ultraviolet light beam across a long open path and measuring the absorbance at specific wavelengths. The technique is capable of analyzing any preselected organic or inorganic volatile compound that can be resolved from compounds naturally occurring in ambient air. Current projected removal applications include perimeter monitoring during site cleanups and measurement of emission source strengths during site assessments.

## **SPECIALIZED ANALYTICAL INSTRUMENTS**

The continuous monitors described above provide qualitative measurement of air contaminants. Quantitative measurements in the field can be obtained using more sophisticated instruments, such as portable Gas Chromatographs, to analyze grab samples.

C Direct Air Sampling Portable Gas Chromatographs (GCs)

Portable GCs use gas chromatography to identify and quantify compounds. The time it takes for a compound to move through a chromatographic column is a function of that specific compound or group of compounds. A trained technician with knowledge of the range of expected concentrations of compounds can utilize a portable GC in the field to analyze grab samples. GCs generally require AC power and shelter to operate. This method is limited by its reliance on a short-term grab sample to be representative of the air quality at a site.

C TAGA Direct Air Sampling Mass Spectrometer/Mass Spectrometer

The Trace Atmospheric Gas Analyzer (TAGA), which is operated by the U.S. EPA/ERT, is capable of real-time detection of preselected organic compounds at low parts-per-billion concentrations. The instrument has been successfully used by the U.S. EPA/ERT for isolating individual emission plumes and tracking those plumes back to their sources.

## APPENDIX B

### Air Sampling Equipment and Media/Devices

#### AIR SAMPLING EQUIPMENT

##### C High-Volume, Total Suspended Particulate (TSP) Samplers

High-volume TSP samplers collect all suspended particles by drawing air across an 8- by 10-inch glass-quartz filter. The sample rate is adjusted to 40 cubic feet per minute (CFM), or 1134 liters per minute (L/min), and it is held constant by a flow controller over the sample period. The mass of TSPs can be determined by weighing the filter before and after sampling. The composition of the filter varies according to the analytical method and the detection limit required.

##### C PM-10 Samplers

PM-10 samplers collect particulates with a diameter of 10 microns or less from ambient air. Particulates of this size represent the respirable fraction, and thus are of special significance. PM-10 samplers can be high-volume or low-volume. The high-volume sampler operates in the same manner as the TSP sampler at a constant flow rate of 40 CFM; it draws the sample through a special impactor head which collects particulates of 10 microns or less. The particulate is collected on an 8- by 10-inch filter. The low-volume sampler operates at a rate of approximately 17 L/min. The flow must remain constant through the impactor head to maintain the 10-micron cut-off point. The low-volume PM-10 collects the sample on 37-mm Teflon filters.

##### C High-Volume PS-1 Samplers

High-volume PS-1 samplers draw a sample through polyurethane foam (PUF) or a combination foam and XAD-2 resin plug, and a glass quartz filter at a rate of 5-10 CFM (144 to 282 L/min). This system is

excellent for measuring low concentrations of semivolatiles, PCBs, pesticides, or chlorinated dioxins in ambient air.

##### C Area Sampling Pumps

These pumps provide flow-rate ranges of 2-20 L/min and have a telescopic sampling mast with the sampling train. Because of the higher volume, this pump is suitable for sampling low concentrations of airborne contaminants (i.e., asbestos sampling). These pumps are also used for metals, pesticides and PAH sampling which require large sample volumes.

##### C Personal Sampling Pumps

Personal sampling pumps are reliable portable sampling devices that draw air samples through a number of sampling media including resin tubes, impingers, and filters. Flow rates are usually adjustable from 0.1 to 4 L/min (or 0.01 to .75 L/min with a restrictive orifice) and can remain constant for up to 8 hours on one battery charge or continuously with an AC charger/converter.

##### C Canister Samplers

Evacuated canister sampling systems use the pressure differential between the evacuated canister and ambient pressure to bleed air into the canister. The sample is bled into the canister at a constant rate over the sampling period using a critical orifice, a mechanically compensated regulator, or a mass flow control device until the canister is near atmospheric pressure.

Pressure canister sampling systems use a pump to push air into the canister. To maintain a higher, more controlled flow, the pump typically controls the pressure differential across a critical orifice at the

inlet of the canister, resulting in a pressurized canister at the completion of sampling.

## AIR SAMPLING MEDIA/DEVICES

If possible, before employing a specific sampling method, consult the laboratory that will conduct the analyses. Many of the methods can be modified to provide better results or a wider range of results.

### C Summa<sup>R</sup> Canisters

Summa canisters are highly polished passivated stainless steel cylinders. The Summa polishing process brings chrome and nickel to the surface of the canisters, which results in an inert surface. This surface restricts adsorption or reactions that occur on the canister's inner surface after collection. At the site, the canister is either placed in a sampler to control sample collection rate, or opened to collect a grab sample. Samples can be collected by allowing air to bleed into or be pumped into the canister. U.S. EPA/ERT uses 6-liter Summa canisters for VOC and permanent gas analysis.

### C Passive Dosimeters

Passive dosimeters are clip-on vapor monitors (samplers) in which the diffused contaminants are absorbed on specially prepared active surfaces. Industrial hygienists commonly use dosimeters to obtain time-weighted averages or concentrations of chemical vapors, as they can trap over 130 organic compounds. Selective dosimeters have also been developed for a number of chemicals including formaldehyde, ethylene oxide, hydrogen sulfide, mercury vapor, nitrogen dioxide, sulfur dioxide, and ozone. Dosimeters must be sent to a laboratory for analysis.

### C Polyurethane Foam (PUF)

PUF is a sorbent used with a glass filter for the collection of semivolatile organic compounds such as pesticides, PCBs, chlorinated dioxins and furans, and PAHs. Fewer artifacts (chemical changes that occur

to collected compounds) are produced than with some other solid sorbents. PUF is used with the PS-1 sampler and U.S. EPA Method TO13. PUF can also be used with personal sampling pumps when sampling for PAHs using the Lewis/McCloud method. Breakthrough of the more volatile PCBs and PAHs may occur when using PUF.

### C Sampling Bags (Tedlar<sup>R</sup>)

Sampling bags, like canisters, transport air samples to the laboratory for analysis. Samples are generally pumped into the bags, but sometimes a lung system is used, in which a pump creates a vacuum around the bag in a vacuum box. Then the sample flows from a source into the bag. This method is used for VOCs, fixed gases (CO<sub>2</sub>, O<sub>2</sub>, and N<sub>2</sub>) and methane.

### C Impingers

An impinger allows an air sample to be bubbled through a solution, which collects a specific contaminant by either chemical reaction or absorption. For long sampling periods, the impinger may need to be kept in an ice bath to prevent the solution from evaporating during sampling. The sample is drawn through the impinger by using a sampling pump or more elaborate sampling trains with multiple impingers.

### C Sorbent Tubes/Cartridges

A variety of sampling media are available in sorbent tubes, which are used primarily for industrial hygiene. A few examples are carbon cartridges, carbon molecular sieves, Tenax tubes and tube containing the XAD-2 polymer. Depending upon the sorbent material, tubes can be analyzed using either a solvent extraction or thermal desorption. The former technique uses standard laboratory equipment and allows for multiple analyses of the same sample. The latter technique requires special, but readily available, laboratory equipment and allows only one analysis per sample. In addition, thermal desorption typically allows for lower detection limits by two or more orders of magnitude. Whenever sorbent tubes are

being used for thermal desorption, they should be certified as "clean" by the laboratory doing the analysis.

#### Thermally Desorbed Media

During thermal desorption, high-temperature gas streams are used to remove the compounds collected on a sorbent medium. The gas stream is injected and often cryofocused into an analytical instrument, such as a GC, for compound analysis:

##### C Tenax Tubes

Tenax tubes are made from commercially available polymer (p-phenylene oxide) packed in glass or stainless steel tubes through which air samples are drawn or sometimes pumped. These tubes are used in U.S. EPA Method TO1 and VOST for volatile nonpolar organic, some polar organic, and some of the more volatile semivolatile organics. Tenax is not appropriate for many of the highly volatile organics (with vapor pressure greater than approximately 200 mm Hg).

##### C Carbonized Polymers

The carbonized molecular sieve (CMS), a carbonized polymer, is a commercially available, carbon sorbent packed in stainless-steel sampling tubes through which air samples are drawn or sometimes pumped. These are used in U.S. EPA Method TO2 for highly volatile nonpolar compounds which have low-breakthrough volumes on other sorbents. When high-thermal desorption temperatures are used with CMS, more variability in analysis may occur than with other sorbents.

##### C Mixed Sorbent Tubes

Sorbent tubes can contain two type of sorbents. Combining the advantages of each sorbent into one tube increases the possible types of compounds to be sampled. The combination of two sorbents can also reduce the chance that highly volatile compounds will break through the sorbent media. An example of a mixed sorbent tube is the combination of Tenax and charcoal with a carbonized molecular sieve. A potential problem with mixed sorbent tubes is the breakthrough of a compound from an earlier sorbent to a later sorbent from which it



cannot be desorbed.

#### Solvent-Extracted Media

Solvent-extracted media use the principle of chemical extraction to remove compounds collected on a sorbent media. The chemical solvent is injected into an instrument, such as a GC, for analysis of compounds. Examples of solvent-extracted media follow:

##### C Chemically Treated Silica Gel

Silica gel is a sorbent which can be treated with various chemicals. The chemically treated silica gel can then be used to sample for specific compounds in air. Examples include the DNPH-coated silica gel cartridge used with U.S. EPA Method TO11.

##### C XAD-2 Polymers

XAD-2 polymers usually are placed in tubes, custom-packed sandwich-style with polyurethane foam, and prepared for use with U.S. EPA Method TO13 or the semi-VOST method. The polymers are used for the collection of semivolatile polar and nonpolar organic compounds. The compounds collected on the XAD-2 polymer are chemically extracted for analysis.

##### C Charcoal Cartridges

Charcoal cartridges, consisting of primary and backup sections, trap compounds by adsorption. Ambient air is drawn through them so that the backup section verifies that breakthrough of the analytes on the first section did not occur, and the sample collection was therefore quantitative. Quantitative sample collection is evident by the presence of target chemicals on the first charcoal section and the absence on the second section. Next, the adsorbed compounds must be eluted, usually with a solvent extraction, and analyzed by GC with a detector, such as a Mass Spectrometer (MS).

##### C Tenax Tubes

Cartridges are used in OSHA and NIOSH methods in a manner similar to charcoal cartridges but typically for less volatile

compounds.

#### Particulate Filters

Particulate filters are used by having a sampling pump pass air through them. The filter collects the particulates present in the air and is then analyzed for particulate mass or chemical or radiological composition. Particulate filters are made from different materials which are described below.

##### C Mixed Cellulose Ester (MCE)

MCE is manufactured from mixed esters of cellulose which are a blend of nitro-cellulose and cellulose acetate. MCE filters are used often for particulate sampling.

##### C Glass Fiber

Glass fiber is manufactured from glass fibers without a binder. Particulate filters with glass fiber provide high flow rates, wet strength, and high, solid holding capacity. Generally, the filters are used for gravimetric analysis of particulates.

##### C Polyvinyl Chloride

Particulate filters with polyvinyl chloride are resistant to concentrated acids and alkalis. Their low moisture pickup and light tare weight make them ideal for gravimetric analysis.

##### C Teflon

Teflon is manufactured from polytetrafluorethylene (PTFE). Particulate filters with Teflon are easy to handle and exceptionally durable. Teflon filters are used for metal collection.

than 0.01% ash. These filters are used to collect particulates.

##### C Silver

Particulate filters manufactured from pure silver have high collection efficiency and uniform pore size. These filters are used for mercury collection and analysis.

##### C Cellulose

Particulate filters with cellulose contain less

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**ATTACHMENT C**

**NIOSH 5503**

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# POLYCHLOROBIPHENYLS

5503

mixture:  $C_{12}H_{10-x}Cl_x$   
[where x = 1 to 10]

MW: ca. 258 (42% Cl ;  $C_{12}H_7Cl_5$ );  
ca. 326 (54% Cl ;  $C_{12}H_5Cl_7$ )

CAS: Table 1

RTECS: Table 1

METHOD: 5503, Issue 2

EVALUATION: PARTIAL

Issue 1: 15 February 1984

Revision #1: 15 August 1987

Issue 2: 15 August 1994

OSHA : 1 mg/m<sup>3</sup> (42% Cl);  
0.5 mg/m<sup>3</sup> (54% Cl)  
NIOSH: 0.001 mg/m<sup>3</sup>/10 h (carcinogen)  
ACGIH: 1 mg/m<sup>3</sup> (42% Cl) (skin)  
0.5 mg/m<sup>3</sup> (54% Cl) (skin)

PROPERTIES: 42% Cl: BP 325 to 366 °C; MP -19 °C;  
d 1.38 g/mL @ 25 °C;  
VP 0.01 Pa (8 x 10<sup>-5</sup> mm Hg;  
1 mg/m<sup>3</sup>) @ 20 °C  
54% Cl: BP 365 to 390 °C; MP 10 °C;  
d 1.54 g/mL @ 25 °C; VP  
0.0004 Pa (3 x 10<sup>-6</sup> mm Hg;  
0.05 mg/m<sup>3</sup>) @ 20 °C

SYNONYMS: PCB; 1,1'-biphenyl chloro; chlorodiphenyl, 42% Cl (Aroclor 1242); and 54% Cl (Aroclor 1254)

SAMPLING		MEASUREMENT	
<b>SAMPLER:</b>	FILTER + SOLID SORBENT (13-mm glass fiber + Florisil, 100 mg/50 mg)	<b>TECHNIQUE:</b>	GAS CHROMATOGRAPHY, ECD ( <sup>63</sup> Ni)
<b>FLOW RATE:</b>	0.05 to 0.2 L/min or less	<b>ANALYTE:</b>	polychlorobiphenyls
<b>VOL-MIN:</b>	1 L @ 0.5 mg/m <sup>3</sup>	<b>DESORPTION:</b>	filter + front section, 5 mL hexane; back section, 2 mL hexane
<b>-MAX:</b>	50 L	<b>INJECTION</b>	
<b>SHIPMENT:</b>	transfer filters to glass vials after sampling	<b>VOLUME:</b>	4-μL with 1-μL backflush
<b>SAMPLE</b>		<b>TEMPERATURE-INJECTION:</b>	250 to 300 °C
<b>STABILITY:</b>	unknown for filters; 2 months for Florisil tubes [1]	<b>-DETECTOR:</b>	300 to 325 °C
<b>BLANKS:</b>	2 to 10 field blanks per set	<b>-COLUMN:</b>	180 °C
<b>ACCURACY</b>		<b>CARRIER GAS:</b>	N <sub>2</sub> , 40 mL/min
<b>RANGE STUDIED:</b>	not studied	<b>COLUMN:</b>	glass, 1.8 m x 2-mm ID, 1.5% OV-17/1.95% QF-1 on 80/100 mesh Chromosorb WHP
<b>BIAS:</b>	none identified	<b>CALIBRATION:</b>	standard PCB mixture in hexane
<b>OVERALL PRECISION (<math>\bar{S}_{RT}</math>):</b>	not evaluated	<b>RANGE:</b>	0.4 to 4 μg per sample [2]
<b>ACCURACY:</b>	not determined	<b>ESTIMATED LOD:</b>	0.03 μg per sample [2]
		<b>PRECISION (<math>\bar{S}_r</math>):</b>	0.044 [1]

**APPLICABILITY:** The working range is 0.01 to 10 mg/m<sup>3</sup> for a 40-L air sample [1]. With modifications, surface wipe samples may be analyzed [3,4].

**INTERFERENCES:** Chlorinated pesticides, such as DDT and DDE, may interfere with quantification of PCB. Sulfur-containing compounds in petroleum products also interfere [5].

**OTHER METHODS:** This method revises methods S120 [6] and P&CAM 244 [1]. Methods S121 [7] and P&CAM 253 [8] for PCB have not been revised.

**REAGENTS:**

1. Hexane, pesticide quality.
2. Florisil, 30/48 mesh sieved from 30/60 mesh. After sieving, dry at 105 °C for 45 min. Mix the cooled Florisil with 3% (w/w) distilled water.
3. Nitrogen, purified.
4. Stock standard solution of the PCB in methanol or isooctane (commercially available).\*

\* See SPECIAL PRECAUTIONS.

**EQUIPMENT:**

1. Sampler: 13-mm glass fiber filter without binders in a Swinnex cassette (Cat. No. SX 0001300, Millipore Corp.) followed by a glass tube, 7 cm long, 6-mm OD, 4-mm ID containing two sections of 30/48 mesh deactivated Florisil. The front section is preceded by glass wool and contains 100 mg and the backup section contains 50 mg; urethane foam between sections and behind the backup section. (SKC 226-39, Supelco ORBO-60, or equivalent) Join the cassette and Florisil tube with PVC tubing, 3/8" L x 9/32" OD x 5/32" ID, on the outlet of the cassette and with another piece of PVC tubing, 3/4" L x 5/16" OD x 3/16" ID, complete the union.
2. Personal sampling pump, 0.05 to 0.2 L/min, with flexible connecting tubing.
3. Tweezers.
4. Vials, glass, 4- and 7-mL, with aluminum or PTFE-lined caps
5. Gas chromatograph, electron capture detection (<sup>63</sup>Ni), integrator and column (page 5503-1).
6. Volumetric flasks, 10-mL and other convenient sizes for preparing standards.
7. Syringe, 10-μL.

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**SPECIAL PRECAUTIONS:** Avoid prolonged or repeated contact of skin with PCB and prolonged or repeated breathing of the vapor [9-11].

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**SAMPLING:**

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the Florisil tube immediately before sampling. Connect Florisil tube to Swinnex cassette and attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.05 and 0.2 L/min for a total sample size of 1 to 50 L.  
NOTE: At low PCB concentrations, the sampler was found to be efficient when operated at flow rates up to 1 L/min, for 24 hours [4]. Under these conditions, the limit of detection was 0.02 μg/m<sup>3</sup>.
4. Transfer the glass fiber filters to 7-mL vials. Cap the Florisil tubes with plastic (not rubber) caps and pack securely for shipment.

**SAMPLE PREPARATION:**

5. Place the glass wool and 100-mg Florisil bed in the same 7-mL vial in which the filter was stored. Add 5.0 mL hexane.
6. In a 4-mL vial, place the 50-mg Florisil bed including the two urethane plugs. Add 2.0 mL hexane.
7. Allow to stand 20 min with occasional agitation.

**CALIBRATION AND QUALITY CONTROL:**

8. Calibrate daily with at least six working standards over the range 10 to 500 ng/mL PCB.
  - a. Add known amounts of stock standard solution to hexane in 10-mL volumetric flasks and dilute to the mark.
  - b. Analyze together with samples and blanks (steps 11 and 12).
  - c. Prepare calibration graph (sum of areas of selected peaks vs. ng PCB per sample).
9. Determine desorption efficiency (DE) at least once for each lot of glass fiber filters and Florisil used for sampling in the calibration range (step 8). Prepare three tubes at each of five levels plus three media blanks.
  - a. Remove and discard back sorbent section of a media blank Florisil tube.
  - b. Inject known amounts of stock standard solution directly onto front sorbent section and onto a media blank filter with a microliter syringe.
  - c. Cap the tube. Allow to stand overnight.
  - d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
  - e. Prepare a graph of DE vs. µg PCB recovered.
10. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

**MEASUREMENT:**

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 5503-1. Inject sample aliquot manually using solvent flush technique or with autosampler.
 

NOTE 1: Where individual identification of PCB is needed, a procedure using a capillary column may be used [12].

NOTE 2: If peak area is above the linear range of the working standards, dilute with hexane, reanalyze and apply the appropriate dilution factor in calculations.
12. Sum the areas for five or more selected peaks.

**CALCULATIONS:**

13. Determine the mass, µg (corrected for DE) of PCB found on the glass fiber filter ( $W$ ) and in the Florisil front ( $W_f$ ) and back ( $W_b$ ) sorbent sections, and in the average media blank filter ( $B$ ) and front ( $B_f$ ) and back ( $B_b$ ) sorbent sections.
 

NOTE: If  $W_b > W_f/10$ , report breakthrough and possible sample loss.
14. Calculate concentration,  $C$ , of PCB in the air volume sampled,  $V$  (L):

$$C = \frac{(W + W_f + W_b - B - B_f - B_b)}{V}, \text{ mg/m}^3.$$

**EVALUATION OF METHOD:**

This method uses 13-mm glass fiber filters which have not been evaluated for collecting PCB. In Method S120, however, Aroclor 1242 was completely recovered from 37-mm glass fiber filters using 15 mL isooctane [8,13,14]. With 5 mL of hexane, Aroclor 1016 was also completely recovered from 100-mg Florisil beds after one-day storage [1]. Thus, with no adsorption effect likely on glass fiber filters for PCB, 5 mL hexane should be adequate to completely extract PCB from combined filters and front sorbent sections. Sample stability on glass fiber filters has not been investigated. Breakthrough volume was >48 L for the Florisil tube at 75% RH in an atmosphere containing 10 mg/m<sup>3</sup> Aroclor 1016 [1].

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**METHOD REVISED BY:**

James E. Arnold, NIOSH/DPSE; S120 originally validated under NIOSH Contract 210-76-0123.

**Table 1. General Information.**

<u>Compound</u>	<u>CAS</u>	<u>RTECS</u>
Polychlorinated Biphenyls	1336-36-3	TQ1350000
Chlorobiphenyl	27323-18-8	DV2063000
Aroclor 1016 (41% Cl)	12674-11-2	TQ1351000
Aroclor 1242 (42% Cl)	53469-21-9	TQ1356000
Aroclor 1254 (54% Cl)	11097-69-1	TQ1360000

**Table 2. Composition of some Aroclors [15].**

<u>Major Components</u>	<u>Aroclor 1016</u>	<u>Aroclor 1242</u>	<u>Aroclor 1254</u>
Biphenyl	0.1%	<0.1%	<0.1%
Monochlorobiphenyls	1	1	<0.1
Dichlorobiphenyls	20	16	0.5
Trichlorobiphenyls	57	49	1
Tetrachlorobiphenyls	21	25	21
Pentachlorobiphenyls	1	8	48
Hexachlorobiphenyls	<0.1	1	23
Heptachlorobiphenyls	none detected	<0.1	6
Octachlorobiphenyls	none detected	none detected	none detected